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height is c inches. It contains water the perpendicular height of which is $\frac{1}{3}c$ inches. What is the greatest height, from the plane on which the vessel rests, to which the surface of the water will rise when the bucket is overturned, no allowance being made for the thickness of the material of the bucket.

63. **Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.**

What is the volume removed by boring an auger hole radius R through a right cylinder radius R, the center of the auger hole to pass at a distance c from the axis of the cylinder and inclined to the axis at an angle α ?

64. **Proposed by E. S. LOOMIS, A. M., Ph. D., Professor of Mathematics, High School, Cleveland, Ohio.**

Find volume and surface generated by revolving about y, the catenary $y=\frac{1}{2}a(e^{x\backslash a}+e^{-x\backslash a})$, from $x=0$ to $x=a$. [*Osborne's Calculus*, page 255, example 8.]

MECHANICS.

48. **Proposed by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas, Texas.**

Two equal heavy rings connected by a string passing over a peg at the focus of a conic section will be in equilibrium at all points on the curve.

49. **Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics, Columbian University, Washington, D. C.**

A rectangular stick of timber of known dimensions is placed upon a platform of given height in a vertical position with the center above the edge of platform, and slightly displaced from the vertical. Where and in what manner will it strike the ground.

50. **Proposed by J. SCHEFFER, A. M., Hagerstown, Maryland.**

A plane quadrilateral $ABCD$ in the vertical wall of a cistern, filled with water, has its four vertices A, B, C, D at the distances 10 feet, 4 feet, 5 feet, and 7 feet respectively, from the surface of the water. The projections of AB, BC, and CD upon the surface are respectively 2 feet, 3 feet, and 1 foot. Find the pressure of the water upon the quadrilateral, and the position of the center of mean pressure.

51. **Proposed by H. C. WHITAKER, A. M., Ph. D., Professor of Mathematics, Manual Training School, Philadelphia, Pennsylvania.**

> "Swift of foot was Hiawatha.
> He could shoot an arrow from him
> And run forward with such fleetness
> That the arrow fell behind him!
> Strong of arm was Hiawatha;
> He could shoot ten arrows upward
> Shoot them with such strength and swiftness
> That the tenth had left the bowstring
> Ere the first to earth had fallen." *Longfellow.*

Assuming Hiawatha to have been able to shoot an arrow every second and to have aimed when not shooting vertically so that the arrow might have the longest range; what was Hiawatha's time in a hundred yards ?

AVERAGE AND PROBABILITY.

47. **Proposed by HENRY HEATON, M. Sc., Atlantic, Iowa.**

What is the average length of the chords that may be drawn from one extremity of the major axis of an ellipse to every point of the curve ?

48. **Proposed by P. H. PHILBRICK, C. E., Pineville, Louisiana.**

A, B, C, D, and E play with dice, each throwing three, three successive times, for a stake a. A, B, and C throw; C throwing the highest, 52. What is his expectation ?

49. Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.

A square whose side is $2a$ and an equilateral triangle whose altitude is $3a$ are fastened together at their centers, but otherwise free to move. If they are thrown on a floor at random, what is the average area common to both?

50. Proposed by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas-Texas.

Find (1), the average length of all straight lines having a given direction, between 0 and a; (2), the average length of chords drawn from one extremity of the diameter a of a semi-circle to all points in the semi-circumference; and (3), find the average area of all triangles formed by a straight line of constant length a sliding between two straight lines at right angles.

[Solutions of these problems should be sent to the editors of the respective departments on or before February 1, 1897.]

EDITORIALS.

Our valued contributor, Prof. O. W. Anthony, has been elected Professor of Mathematics in the Columbian University, Washington, D. C.

James F. Lawrence, I. F. Yothers, G. B. M. Zerr, J. C. Corbin, Frederick R. Honey, H. C. Wilkes, and Nelson S. Roray should have received credit for solving Nos. 66, 67, 68, and 69, Department of Arithmetic. O. W. Anthony should have received credit for solving No. 63, Department of Geometry. We wish to state again that all solutions, to receive credit, should be sent to the proper editor; but this remark does not apply to the above persons.

The MONTHLY will soon begin its fourth volume. Will not every one of its old subscribers try and secure one new subscriber for the coming year? Send us names of persons likely to subscribe and we shall take pleasure in sending them sample copies. Persons sending us three new subscribers and remitting us $6.00 will receive a years subscription as a premium.

Some of our readers have suggested that we publish in groups portraits of our contributors. If this suggestion meets the approval of our contributors, we shall be pleased to receive photos which we will have grouped by one of the best artists in Springfield, and shall furnish the plates at cost to us. We shall be pleased to hear from the contributors to the MONTHLY in reference to this matter.

A letter from Dr. Halsted dated November 27th, 1896, says, "For four months I was buried in the uttermost parts of Hungary, Russia, and Siberia, and am just getting used to English again. I made many important finds and had many strange experiences." There are few other Americans whose travels in Russia would have been as important to the Non-Euclidean Geometry as this trip of Dr. Halsted's. He is already working on some very important translations which will soon be made known for the first time to English speaking mathematicians.